PC5000

Process Controller

USER MANUAL

SUPPLIED BY

PLASMA TECHNOLOGY

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SECTION 1

SAFETY

1. SAFETY

* * * WARNING * * *

ALL PERSONNEL WHO WORK WITH OR ARE EXPOSED TO THIS EQUIPMENT MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS AND/OR FATAL BODILY INJURY.

PROPER USE AND SAFE OPERATING PROCEDURES OF THIS EQUIPMENT ARE THE RESPONSIBILITY OF THE USER. READ AND UNDERSTAND THIS MANUAL BEFORE OPERATING, INSTALLING, OR SERVICING THIS EQUIPMENT.

The company provides information on its products and associated hazzards, but assumes no responsibility for the after-sale operation and/or safety practices.

Only properly trained personnel should install or maintain this equipment. Use only approved procedures, and refer to this manual at all times.

Take appropriate action to protect personnel and property from accidental hardware or software faults.

DO NOT BE CARELESS AROUND THIS EQUIPMENT!

Throughout this manual, the following terms will be included where appropriate caution should be exercised. Refer to this information before attempting the described operation.

DANGER Indicates the presence of hazzards that will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING Indicates the presence of hazzards whick can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION Indicates the presence of a hazzard which will or can cause minor personal injury or property damage if the warning is ignored.

(CONTINUED)

ELECTRICAL HAZZARD

* Equipment connected to or controlled by this product may TURN ON OR OFF UNEXPECTEDLY. Always remove power from all controlled equipment before servicing. DO NOT ASSUME INTERLOCKS WILL PREVENT ACCIDENTAL OPERATION OF CONTROLLED EQUIPMENT!

* Before removing the cover(s) to this equipment for service or adjustment, INSURE THAT THE POWER CORD HAS BEEN DISCONNECTED.

* Make certain that the chassis is properly grounded. The wire provided in the power connector should NOT be defeated!!

GAS HAZZARD

* If TOXIC or NOXIOUS gases are controlled by this equipment, DO NOT RELY ON THE INTERLOCKS AND/OR VALVE CONTROLS TO SHUT OFF GAS. If in doubt about a gas leak, ASSUME there is a leak and act accordingly.

* Always consult the current published safety regulations and Gas Manufacturer's Material Safety data sheets before handling gases. Follow the Gas Manufacturer's instructions for manually purging and disconnecting gas(es) before servicing system.

* Use only those gases specified or approved by the manufacturer for use in your system. Do NOT change the type or quality of gas without prior WRITTEN approval from the manufacturer.

MECHANICAL HAZZARD

* Insure the vacuum chamber door is CLOSED before starting a process run. If the vacuum valve should operate with the door slightly open, a pinched finger can result.

* The chamber electrodes can reach high temperature and cause severe burns even after a process is complete. ALWAYS wear protective gloves when reaching into the chamber to avoid burns to the hands and arms.

* Mechanically operated safety interlocks should never be over-ridden or jumpered out. Service personnel should always follow approved procedures when repairing and maintaining the system.

SECTION 2

SYSTEM OPERATION

2. SYSTEM OPERATION

This section provides basic information for operating the PC5000 after it has been personalized by entering limits and setpoints for each PROCESS into the memory.

Information about how to run, stop, restore and reset the controller is presented here. Some details about what the numbers and data mean are left for the DATA OPERATIONS and PROCESS DESIGN sections. However, the concepts presented here should be sufficient to learn and perform most routine system operations.

FIRST TIME USE

Persons unfamiliar with the PC5000 should acquaint themselves with the following information.

1) Always read the SAFETY section first!

2) The section on OPERATION is best explored by using the PC5000. Try some of the examples to develop proficiency in operating and modifying your PC5000.

3) If something does not seem to work, check the KEY SWITCH position and the RUN and HOLD status lights. Many functions require the PC5000 to be in a certain state before changes may be made. Generally, a short 'ding' will be heard when a key is pressed if the controller is in the wrong state.

4) The appendices provide additional details about the system and the 'programs' included with your system by the factory. A glossary of terms used in this manual is provided, as are ERROR codes and flow charts.

Go slowly -- most operations or functions can be done by pressing only one or two keys. Remember that you are not 'programming' a computer -- just providing limits and setpoints for your process.

FRONT PANEL DESCRIPTION

All of the lamps on the front panel, including those on the switches, are used to present information to the operator. The remainder of this manual will refer to the following groups:

STATUS DISPLAY — These lights display the most important information about the status of the system. Alarms and malfunctions appear here, along with indicators of system activity.

DATA DISPLAY — The PC5000 will automatically display appropriate values, limits and setpoints here, using the 4 'label' lights to help describe what the values mean. The operator can override these choices and look at most of the system values on this display instead.

This display is also shows the digits as data values are entered from the DATA keypad. Error messages will be posted here when improper operations or conditions are detected.

FIXED DISPLAYS — Two dedicated displays present data values for the most important system measurements. 'Label' lights are used to aid the user in determining status of these measurements.

CONTROL SWITCHES — The RUN and STOP switches enable the PC5000 to automatically start and process a complete multi-step batch without further intervention. The TEST switch does both a LAMP test and a full set of diagnostic self-tests. The POWER switch turns the PC5000 on and off.

DATA SWITCHES — The numeric keypad is used for entering data during a SET operation. The keypad is also used in conjunction with the PROCESS and STEP/ENTER switches for selecting and displaying the current process and step numbers.

FUNCTION SWITCHES — The switch lamps mimic the state of the named control functions. When flashing, the corresponding function is being performed. When on solid, the LED shows the function has been completed or is active.

The top label on the FUNCTION switches indicates both the function name and the operation performed in MANUAL mode. The bottom label indicates the PARAMETER name used in setting and reading functions.

KEY SWITCH MODES

The PC5000 has three general modes of operation, with specific functions allowed or prohibited in each mode. The mode is selected by the KEY SWITCH on the right side of the operators panel. The three modes are:

LOCK — In this mode, the operator is restricted to selecting a PROCESS, running and pausing within the PROCESS, and displaying (but not altering) the parameters and measured data. The system will function automatically in this mode to initiate a complete cycle of the selected PROCESS.

The KEYSWITCH should be in the LOCK position for automatic operation, because all setup information and sequencing is protected in this mode.

MANUAL — All functions that can be performed in LOCK mode can be performed in MANUAL mode also. Additionally, the FUNCTION switches can be used to manually turn on or off GASES, etc., and to VENT or pump down to VACUUM. Only the actual parameters and control outputs can be altered in this mode. Memory setpoints and limits can never be altered!

MODIFY — All functions that can be performed in LOCK mode can be performed in MODIFY mode also. Additionally, the setpoints and limits in MEMORY can be altered only when the KEY SWITCH is in MODIFY.

Any time that a particular operation or function does not seem to work, the user should confirm the KEY SWITCH is in the appropriate position for the attempted function.

THE CURRENT PROCESS

Only one of the nine available processes can be selected as the CURRENT PROCESS. To determine which one is selected, press the PROCESS switch (grey switch in the DATA switch group). The lamp on this switch will light, and one of the numbered DATA switch lamps will be on. This switch number is the current PROCESS number.

Pressing the PROCESS switch is not always necessary to determine the current process. When the lamp in the PROCESS switch is lit, the DATA switch currently lit automatically displays the current process number.

EXAMPLE: Press and hold the grey PROCESS switch. If DATA switch number 3 is lit, the current process is PROCESS 3. Release the PROCESS switch.

EXAMPLE: The STEP/ENTER switch LED is blinking and pressing the PROCESS key will not display the process. The process can not be displayed because an ENTER operation is in progress.

EXAMPLE: The STEP/ENTER switch LED is lit and DATA switch number 5 is lit. Instead of showing the current process, the current STEP of the process is shown (i.e., step 5). Pressing the PROCESS switch will turn off the STEP switch and the current process will light the appropriate DATA switch LED. Pressing the STEP switch again, if desired, will return to displaying the current step within the process.

PROCESS STATUS

The currently selected PROCESS in the PC5000 will be in one of four states, determined by the lights in the STATUS display:

RUN — When the RUN light in the STATUS panel is lit (the RUN switch LED is on also), the controller is executing the currently selected PROCESS. In this mode, the current PROCESS selection may not be altered. The system will function automatically to completion, then extinguish the RUN light and become IDLE.

HOLD — When the HOLD light in the STATUS panel is flashing, the currently selected PROCESS has been interrupted before normal completion. The process can be resumed by pressing the RUN switch.

IDLE — When neither the RUN or HOLD lights are lit, the controller is IDLE. A different PROCESS number can be selected only in this mode. This is also the recommended mode to read and modify setpoints and limits in memory.

FAULT — When any of the alarms in the STATUS display are flashing, the controller is disabled. Any PROCESS that was running is put into HOLD, and the only operation possible is to reset the alarm condition. (Pressing the STOP switch momentarily will silence the BELL and attempt to reset the alarm.)

The operator should become familiar with the RUN, HOLD, IDLE and FAULT states and learn to recognize them quickly. Many operations can be performed only in one of these states. Information about causes of a process malfunction can be gained here also.

EXAMPLE: The HOLD light is flashing in the status display. The operator should realize that the current process was suspended before completion. The process can always be resumed by pressing the RUN switch.

EXAMPLE: The operator tries to select another PROCESS to be run. The PC5000 dings and will not allow the selection. The HOLD light is flashing, indicating that a previous PROCESS has not yet completed. A new selection can not be made until the previous run is completed or aborted.

EXAMPLE: The alarm bell has started ringing. The operator observes the STATUS panel and determines that the HOLD LED and one of the LIMIT ALARM lights is flashing. The PC5000 has found a condition, such as no gas FLOW or excessive TEMPERATURE, that prohibits further processing. The STOP switch can be pressed and released to silence the bell. After the fault is corrected, the PROCESS can be resumed by pressing the RUN switch.

EXAMPLE: The PC5000 is powered on with the blue POWER switch. The INTERLOCK alarm light is flashing. The operator presses the STOP switch and the INTERLOCK alarm stops flashing. A power down/power up is considered an interlock alarm and requires the operator to acknowledge the failure by pressing the STOP switch.

EXAMPLE: The INTERLOCK alarm is flashing and the alarm bell is ringing. The STOP switch is pressed and the bell is silenced. The INTERLOCK alarm light does not stop flashing. An unsafe condition, such as a loose cover or maintenance panel not secured, exists. After the fault is corrected, pressing the STOP switch again extinguishes the INTERLOCK alarm light.

SELECTING A PROCESS

Verify that the HOLD light in the STATUS display is off, since a new PROCESS may be selected only in IDLE mode. The new PROCESS may be selected by pressing and holding the grey PROCESS switch and then pressing the desired keyswitch number on the DATA switches. This switch LED will light if the desired PROCESS is a valid selection, or the alarm will 'beep' if invalid.

EXAMPLE: The operator desires to use PROCESS 4 for the next batch run. Press and hold the grey PROCESS switch and then press DATA switch 4. Release both switches.

EXAMPLE: The operator desires to use PROCESS 6 for the next batch run. When the PROCESS switch is held and the DATA switch 6 is pressed, the alarm bell 'dings' and switch 6 does not light. Check the HOLD light in the STATUS panel. It is probably flashing, indicating that the previous process has not completed.

NOTE: It is not necessary to re-select the same PROCESS before each run.

RUNNING A PROCESS

To run a PROCESS, determine if the HOLD light is flashing. If it is, pressing the RUN switch will continue a previously suspended PROCESS. If the HOLD light is not flashing, pressing the RUN switch will cause the entire currently selected PROCESS to be run.

When the PROCESS is complete, the RUN light will extinguish, allowing either another PROCESS to be selected, or the current PROCESS to be run again.

If the INTERLOCK alarm in the STATUS display is flashing or if the SELF-TEST is running, pressing the RUN switch will cause the alarm bell to 'ding' and the PROCESS will not start.

SUSPENDING A RUNNING PROCESS

If the STOP switch is pressed briefly while a PROCESS is running, the PROCESS will be put in HOLD and can be restarted using the RUN switch. Sufficient information about the current PROCESS will be saved to allow the PROCESS to be re-started at the beginning of the proper step.

EXAMPLE: The operator has been informed to suspend any run that doesn't reach a minimum chamber temperature. When this occurs, the STOP switch is pressed and released, putting the PROCESS in HOLD.

ABORTING A PROCESS

If the STOP switch is held continuously for 5 seconds, any PROCESS running or in HOLD will be permanently halted, and can only be restarted from the beginning of the entire PROCESS. All information required to continue the PROCESS will be lost!

After the STOP switch is held for 2 seconds, the ALARM BELL will start ringing to inform the operator that an ABORT will take place if the STOP switch continues to be held. The switch may be released before 5 seconds have passed without causing an ABORT.

IMPORTANT: An abort will not stop instantly, but will skip to the last step of the process. A PURGE cycle will be performed if gas had been admitted to the chamber. A VENT cycle will be performed if the chamber was under vacuum. During this cycle, the HOLD light in the STATUS panel will flash.

The ABORT operation can be used to remove a partially completed PROCESS from HOLD to allow a new selection to be made, since a new PROCESS can be selected only when no PROCESS is running or in HOLD.

EXAMPLE: The operator failed to select the proper PROCESS before pressing RUN. Almost immediately, the error was noticed and the STOP switch was pressed. If standard procedures allow, the operator may hold the STOP switch in for 5 seconds to abort the process. NOTE: Partially completed processes may not be satisfactorily aborted and then re-run.

EXAMPLE: The current process has started to run, but the chamber door seal is not tight. The PROCESS may be aborted by pressing the STOP switch for 5 seconds.

EXAMPLE: The current process is almost complete. The operator holds the STOP switch in to cause an abort. Most likely, the batch in progress will be incompletely processed, and to restart the entire process again will over-process and ruin the batch. Standard procedures must be determined for such incidents.

RUNNING THE SELF-TEST

The TEST switch performs two functions -- a LAMP test and a SELF-TEST. By momentarily pressing the TEST switch, all front panel lamps will be lit to allow checking for defective lights.

The PC5000 verifies its internal programs and systems by performing a set of self tests. This is done automatically upon power on, and can be repeated when desired by pressing and holding the TEST switch for 5 seconds. Several internal tests will be performed, and a PASS or FAIL will be displayed. The self test can only be done when the PC5000 is not running a PROCESS.

MANUAL OPERATION

Manual operation of the PC5000 is provided for correcting problems and for developing new sequences. It is not intended as a normal operator function.

WARNING: It is possible during MANUAL opeation to perform opeations, such as mixing incompatible gases or exceeding certain limits, that could endanger the operator. Only qualified personel should operate the controller in MANUAL.

When the KEY SWITCH is in MANUAL, the FUNCTION switches can perform their operations when initiated by the operator. If the controller is running a PROCESS, some of the MANUAL functions will be locked out. If the controller is IDLE, the MANUAL functions can be used to sequence the outputs similarly to the automatic mode.

To perform a MANUAL function, insure the KEY SWITCH is in MANUAL. Then press and hold the grey MANUAL switch and then press the desired FUNCTION switch. If a 'ding' is heard, examine the display for an Error Code number. The table of error codes will explain why the MANUAL function was not allowed.

EXAMPLE: The system is idle and the operator wishes to put the chamber under vacuum for overnight storage. Put the KEY SWITCH in MANUAL, and then press and hold the MANUAL function switch and press the ROUGH FUNCTION switch. If the doors are closed and other conditions are proper, the chamber will pump down to vacuum.

EXAMPLE: The chamber has pumped down and the operator wishes to close the ROUGH valve. Press the MANUAL and ROUGH switches to turn the ROUGH switch lamp OFF. The controller will close the valve.

EXAMPLE: The controller is running a process and the operator wishes to turn the THROTTLE valve off (open). Pressing MANUAL and then THROTTLE will toggle the throttle valve on and off each time the switch is pressed.

Once a MANUAL function has begun, no additional MANUAL function may be started. If this is attempted, the controller will 'ding' without performing the function. For example, after turning GAS 1 on manually, the operator must wait until the GAS 1 lamp stops flashing before he can be turn off GAS 1 manually.

Entering SETPOINTS and LIMITS in MANUAL mode does not store the data into memory, but just sends the data to the analog outputs. See the section on ENTERING ACTUAL DATA below.

When a non-zero data value is entered (SET) in MANUAL, both the analog output is enabled as well as the control output. Entering 75 percent on GAS 1, for example, causes the gas solenoid to open and the flow controller to allow 75 percent gas flow. When a zero value is entered, the control output turns off as well.

SECTION 3

DATA OPERATIONS

3. DATA OPERATIONS

Data is used by the PC5000 to perform various set up, operation, and maintenance functions. The operator can monitor specific instrument readings and values. The process engineer can implement new PROCESSes and modify existing setpoints and limits. System diagnostics and verification can be performed while using minimal external equipment.

This section will provide methods to enter and access data for the operator and systems engineers. The terminology should be understood before attempting modification of the PROCESS parameters.

DATA TYPES

Two types of numeric data are defined for the PC5000, the MEMORY SETPOINT values and the ACTUAL PARAMETER values. The rest of this section refers to these names and requires understanding of their meaning.

SETPOINTS: Setpoints are the data stored in the memory of the PC5000. Examples of setpoints are GAS FLOW(S) required, RF LEVEL for desired plasma, and TIME duration of a step. Limits such as TEMPERATURE HI-LIMIT and THROTTLE PRESSURE are also regarded as setpoints.

ACTUALS: Actual parameters are the values measured or calculated by the controller from the system instruments. Measured values include actual GAS FLOWs for gas channels, the TEMPERATURE and PRESSURE of the chamber, and RF power delivered to the chamber. Calculated values include TIME remaining in a step, number of cycles remaining, and ALARM or LIMIT detection.

DATA MEMORY

Reference is often made to the MEMORY in the PC5000. This is an area in the controller set aside for storing data that customizes each of the user's processes. Once 'entered' in the memory, data will permanently be saved until altered again by the user. Powering the unit off will not cause the memory to 'forget' its data.

MEMORY is organized into 9 major groups of data. Each PROCESS owns its own group of memory that is independent of other processes. Data contained in a particular PROCESS memory can only be displayed or altered when that PROCESS is the currently selected process.

Each PROCESS memory group is itself organized into 8 sub-groups of data, with one sub-group for each STEP of each PROCESS. Again, the data in each STEP sub-group is independent from the data in all other STEPs, and can be displayed or altered only when the currently selected PROCESS has selected one of its STEPS as the current step. (More about this later.)

To summarize, there are a maximum of 72 distinct areas in the MEMORY, and only one of these areas (sub-groups) can be selected at any time for displaying or altering the data in that area. Both the currently selected PROCESS and the current STEP within that process determine which memory sub-group is active.

SELECTING DATA

The user has access to two types of data -- the ACTUAL measured or calculated values in the system, and the memory SETPOINT values. The KEY SWITCH on the front panel determines which:

LOCK or MANUAL	When the KEY SWITCH is in either of these positions, the ACTUAL values are available to the user.
MODIFY (MEMORY)	When the KEY SWITCH is in this position, the MEMORY SETPOINT values are availble.

The FUNCTION SWITCH group is used to select the data value to be displayed or altered, after using the KEY SWITCH to determine whether memory or actual data is to be displayed or altered.

Each of the FUNCTION switches has a NAME engraved on the switch, describing a system function, operation, instrument or value. Depending on the engraved lettering, a switch may have one of the following capabilities:

* If the switch has RED lettering, there is both a memory SETPOINT and an ACTUAL value associated with the switch.

* If there is only white letters, the function switch has no memory or actual data associated with it.

All of the FUNCTION switches with RED lettering (meaning that a data value is associated with the switch) make up a list of named data. This list, which contains values for every function, corresponds to a sub-group of MEMORY. Thus, each STEP of each PROCESS has its own unique list stored in its own memory area.

Another way of viewing this is that each FUNCTION switch with a RED label has 72 different SETPOINT values in the memory. The current PROCESS and current STEP determines which of these 72 is to be used.

Each of the FUNCTION switches with a RED label also refers to an ACTUAL measured or calculated value related to the function. These actual values are times, percents, etc. obtained from the system (and not from memory).

The following diagram illustrates the DATA SELECTION in the PC5000.

The FUNCTION switches are used in conjunction with the grey SET and READ switches (and the KEY SWITCH) to perform the desired data access, i.e.:

READ ACTUAL GAS 1 FLOW implies displaying the measured flow of gas 1.

READ GAS 1 FLOW SETPOINT implies displaying the data in memory for the desired gas 1 flow.

SET ACTUAL TIMER implies entering a new value to replace the actual time remaining in the timer. This is very different from:

SET TIMER SETPOINT which implies changing the memory value to be loaded into the timer at the beginning of a step.

READ VENT returns an error code because this function switch has no red label, thus no data value.

AUTOMATIC DATA DISPLAY

When the controller is running a PROCESS, it attempts to display appropriate setpoints or actual values in the DATA window, along with an indication of what type of data is being presented.

When a value is displayed in the DATA display, observe the 'label' lamps in the display. If the label indicator is blinking, the data is always a MEMORY SETPOINT. If the indicator is on solidly, the data is an ACTUAL (measured) value.

It is not always possible to tell which parameter is actually being displayed on the window. By pressing the READ switch (the grey function switch), all of the FUNCTION switch lamps will go off except the switch representing the parameter being displayed. When the READ switch is released, the FUNCTION switch lamps return to their original "mimic" function.

Within a short time, the user will know what values to expect on the display, and can usually dispense with pressing the READ switch to verify the value.

READING ACTUAL VALUES

Any of the FUNCTION switch parameters can be displayed on the DATA window by pressing and holding the READ switch and simultaneously pressing the desired FUNCTION switch. While the READ is continuously held, the selected ACTUAL value, if any, for the function is displayed.

Actual values may be read at any time; remember that the KEY SWITCH must be in LOCK or MANUAL. It does not matter whether a PROCESS is running or in hold. Reading actual values will always display the instantaneous measurement or calculation. In some cases, the value has little meaning and displays as zero.

During a READ operation, the lamps in the FUNCTION switches all go off except the selected switch. When the READ switch is released, the lamps return to their original 'mimic' states. The previous contents of the DATA display will also be restored after releasing the READ switch.

EXAMPLE: To read the actual flows of GAS 1, press and hold the READ switch and then press GAS 1 (FLOW) switch. The DATA display will show a value with a PERCENT label. This is the measured flow.

EXAMPLE: To read the time remaining (if any) in the timer, press and hold READ and then press the TIMER (TIME) switch. The DATA display will show a value of MINUTES and hundredths of minutes. If this value is zero, there is no time remaining and the timer will remain zero until it is reloaded from the memory.

EXAMPLE: To read the chamber temperature, press and hold the READ switch and then press the TEMP (LIMIT) switch. The temperature will be displayed, along with a CENTIGRADE label lamp, until the read switch is released.

EXAMPLE: Try pressing the READ switch and then one of the FUNCTION switches that has no associated data value (no RED lettering). The DATA display will show EC--, which means ERROR CODE -- (no data available).

READING SETPOINTS

Displaying the SETPOINTS from memory can occur at two different times. First, when the PC5000 is running a PROCESS and the user wishes to look at the memory associated with the current STEP of the process. Second, when the user wishes to examine memory SETPOINTS for all STEPS of a PROCESS. In this case, the controller must not be running or in hold.

The first case, in which the current memory is to be examined, is just like reading ACTUAL values, except the KEY SWITCH must be turned to MODIFY (MEMORY) before pressing READ and the desired FUNCTION switch.

The SETPOINT value in memory is displayed by press and holding the READ switch and while holding it on, simultaneously press the desired FUNCTION switch. The SETPOINT value of the parameter will be displayed in the DATA window, with the appropriate label lamp blinking, until the READ switch is released.

EXAMPLE: The timer is currently ON and counting down. The operator wishes to see what the initial setpoint loaded into the timer from memory was. By turning the KEY SWITCH to MODIFY and pressing the READ switch, followed by the TIMER (TIME) switch, the DATA display will show the initial SETPOINT time.

EXAMPLE: The operator wishes to verify the requested GAS 1 FLOW setpoint for the current step. Pressing READ and then GAS 1 FLOW, the memory setpoint is displayed. This value can be compared to the ACTUAL GAS 1 FLOW by turning the KEYSWITCH to MANUAL or LOCK and again pressing READ and then GAS 1 FLOW, displaying the measured flow.

EXAMPLE: The operator wishes to examine the current TEMP limit in memory. After turning the KEY SWITCH to MODIFY, the READ switch is pressed and held. Before the TEMP (LIMIT) switch can be pressed, the current STEP is completed and the PC advances to the next STEP. The TEMP limit displayed will be for this new STEP, since only memory from the current STEP may be displayed.

The second case, in which all memory SETPOINTS for an entire PROCESS, are to be displayed, requires the following conditions:

* The PC5000 must be in IDLE mode to examine any memory other than the SETPOINTS associated with the current STEP and PROCESS.

* The KEY SWITCH must be in MODIFY (MEMORY) position.

* The user must select both a PROCESS number and a STEP number within that PROCESS before accessing memory.

Since the user wants to examine more of the memory than is available to the current PROCESS STEP, the desired STEP must be set first. The procedure for selecting the desired memory is this:

* Set the KEY SWITCH to MODIFY (MEMORY) position.

* Insure that the controller is IDLE by verifying that both the HOLD lamp in the status display and the run lamp are OFF. A suspended process must be aborted before any other PROCESS or STEP can be selected.

* Press the grey PROCESS switch to verify that the desired PROCESS is selected. If another PROCESS is desired, continue holding the PROCESS switch while pressing the number corresponding to the process.

* Press the grey STEP (ENTER) switch and observe which DATA switch number is lighted. This is the current STEP number. If another STEP (within the current PROCESS) is desired, continue holding the STEP (ENTER) switch and then press the desired DATA switch number.

Each of the memory SETPOINTS for the selected PROCESS and STEP can now be displayed by pressing and holding the READ switch and then the desired FUNCTION switch. It is not necessary to reselect a STEP to look at additional values for the STEP. Just repeat the READ and FUNCTION sequence.

To examine the memory for the next STEP, the user must press the grey STEP switch along with the desired DATA switch number. Note that only STEPS 1 through 8 are available for each PROCESS; STEP 9 is a purge and vent cycle and uses the memory values from STEP 1.

EXAMPLE: The TIMER setpoints for all 8 STEPS in the current PROCESS are to be examined. The operator selects STEP 1 and then presses the READ and TIMER switches to display the memory setpoint for the timer. STEP 2 is then selected and then the READ and TIMER switches are pressed. This is repeated for all 8 STEPS.

SETTING SETPOINTS AND LIMITS

Entering SETPOINTS into memory falls into two distinct cases, just as reading from memory does. First, if the controller is running a PROCESS, the user may enter data only into the memory for the current STEP. Second, if memory data is to be entered into all STEPS of a PROCESS, the controller must be IDLE.

In the first case, the memory SETPOINTS for the current PROCESS and STEP are to be altered. The KEY SWITCH must be set to MODIFY (MEMORY).

To enter a SETPOINT, press and hold the SET switch, and simultaneously press the desired FUNCTION switch. Two things will happen: The DATA switch LED's will all light, indicating that they are to be used to enter data. Also, the SET and STEP (ENTER) switches will flash to indicate that data may now be entered.

If the user inadvertantly enters the SET mode, pressing the SET again will abort the operation and no data will be written to memory.

Once the SET mode is active, numbers may be entered on the key-pad, and will be "scrolled" into the DATA display above. When the desired number is in the display, pressing the STEP (ENTER) switch will enter the data into memory. If a mistake is made entering data, press the zero (0) data 4 times to clear the display and then re-enter the number. Any time before the STEP switch is used to actually enter data into memory, the SET switch can be used to abort the memory modification.

EXAMPLE: To change the GAS 1 FLOW SETPOINT in memory, put the KEY in MODIFY. Then press the SET switch and while holding it, press the GAS 1 FLOW switch. The DATA lights will all come on allowing the new setpoint to be entered. When the STEP (ENTER) switch is pressed, the data will be entered into memory and into the current ACTUAL flow if GAS 1 is already on.

The second case involves entering SETPOINTS for all STEPS of any PROCESS. This mode is used to "customize" the controller for each PROCESS.

To enter SETPOINTS into the PC5000 memory, the user must first put the KEY SWITCH in MODIFY (MEMORY) mode. The user must also have selected the PROCESS and STEP desired. See READING SETPOINTS above for details. If necessary, press the PROCESS and then STEP switches to verify that the proper STEP memory is to be modified.

Remember that any PROCESS or STEP, except the current one, can not be selected unless the controller is IDLE (RUN and HOLD LED's are off).

To set all the parameters for PROCESS 1, follow this procedure:

* First, press the PROCESS switch and verify that PROCESS 1 is selected. Press the STEP switch and verify that STEP 1 is selected. If necessary, select the proper STEP and PROCESS numbers.

* To enter the TIME setpoint, press SET and TIME simultaneously. The previously entered setpoint will be displayed. Enter the desired new setpoint using the number pad, and then press STEP to enter the data into memory. If the previous setpoint was already correct, the SET switch could have been pressed to abort the data update.

* Repeat this procedure for the GAS 1,2, and 3 functions, as well as all other switches with associated memory SETPOINTS (switches with RED labels).

* Finally, press the READ and each of the FUNCTION switches in turn to verify the contents of the memory for STEP 1.

* If STEP 2 is to be constructed, select it by pressing STEP switch and then the 2 switch. Memory can then be entered for each FUNCTION switch as above. This process can be repeated for STEPS 3 through 8, if desired for the PROCESS.

It is always good practice to press the PROCESS and STEP switches after modifying data, to verify that the appropriate set of parameters was modified. Also, each STEP of each PROCESS should be examine (READ) to insure that only intended SETPOINTS have been entered.

SETTING ACTUAL VALUES

When the PC5000 is running a PROCESS, the operator can MANUALLY alter the ACTUAL values being sent to the system. IMPORTANT: Altering some values may have disasterous effects on the batch being processed. It is recommended that entering actual values be done by someone very familiar with the PROCESS.

Entering a new value for one of the current ACTUAL parameters is similar to entering that value in memory. First, the KEY SWITCH must be set to MANUAL to select ACTUAL mode. Press and hold the SET switch while selecting the FUNCTION to be altered. Once selected, that FUNCTION switch will remain lighted and the DATA switches will all light to indicate that a SET is being done.

Enter the desired value using the DATA switches. When the value is correct, press the STEP (ENTER) switch to send that value to the hardware. If a SET operation is started and the ENTER switch not pressed, it may be cancelled by pressing the SET switch again <u>without</u> altering anything.

EXAMPLE: The running PROCESS has started the timer and the user wishes to adjust the time <u>remaining</u> temporarily for this STEP. By putting the KEY SWITCH in MANUAL mode rather than MEMORY, the ACTUAL timer will be altered rather than the memory SETPOINT.

The SET switch is pressed and held while the TIMER switch is pressed. The desired time is entered on the DATA display using the DATA switches. The STEP (ENTER) switch is then pressed to load the value into the timer.

EXAMPLE: The user wishes to increase the GAS 1 FLOW temporarily for the currently running STEP. With the KEY SWITCH in MANUAL, the SET is pressed and held while GAS 1 is pressed. The new desired GAS 1 flow is entered in the DATA display and the STEP (ENTER) switch is pressed. The new flow can then be read by pressing READ and GAS 1.

EXAMPLE: The user wishes to change the GAS 1 FLOW as above. However, the PC5000 has just turned off all gases. If a GAS 1 is entered as above, it is possible that the controller may not realize that gases should be off, and will allow the entry. This can cause problems beyond belief.

EXAMPLE: The user wishes to enter a GAS flow as above. When he presses ENTER, however, the display show ECnn and the alarm dings. The ERROR Code nn will indicate the reason that the new entry can not be performed.

Again, a word of caution. If the controller completes the current STEP and progresses to the next step, any ENTER in progress will affect the new STEP with possible problems.

SUMMARY OF OPERATION

--- Switch(es) ---	---------- Function/Description ----------
PROCESS	Displays the current process number by lighting appropriate DATA switch LED.
PROCESS + DATA SW	Selects PROCESS number corresponding to DATA switch as current process.
STEP	Displays the current step of process on DATA switch LED's.
STEP + DATA SW	Selects a different STEP of current PROCESS.
READ	Shows exactly which parameter is in the DATA display by lighting only the appropriate FUNCTION switch LED.
READ + FUNCTION SW	Displays paramater associated with a FUNCTION switch on DATA display. If KEY SWITCH is in MANUAL, displays ACTUAL value. If KEY SWITCH is in MODIFY, displays SETPOINT from memory for current PROCESS and STEP. If no value is allowed, error EC-- displayed. Original display returns when READ switch released.
MANUAL	This switch must be used with one of the FUNCTION switches.
MANUAL + FUNCTION	If KEY SWITCH is in MANUAL position, the function is performed. Error codes may appear if function can not be performed. See Error Code table for explaination.
SET	This switch must be used with one of the FUNCTION switches. NOTE: The SET switch may be pressed anytime during SET to cancel the entry without altering existing data.
SET + FUNCTION SW	If KEY SWITCH is in MANUAL, selects data entry for ACTUAL output to system. If KEY SWITCH is in MODIFY, selects data for entry in MEMORY for current PROCESS and STEP. Data will not be entered until the ENTER switch is pressed. Error codes may appear (EC nn) if a particular parameter can not be altered.
ENTER	Causes data from the keyboard during a SET + FUNCTION operation to be stored in MEMORY or in ACTUAL outputs. When active, ENTER switch blinks and all DATA switch LED's are on.
STOP	If flashing, will silence ALARM bell and attempt to reset INTERLOCKS. If process is running, will suspend in HOLD mode when pressed momentarily. When held for 5 seconds, will ABORT current PROCESS.

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